WHAT IS CLAIMED IS:

1. A method of removing residual tones in a shuffled output data stream, comprising:

   (a) separating an input data stream into alternating even input data samples and odd input data samples, wherein the input data stream has a data sample rate equal to *Fs*;

   (b) shuffling each of the even input data samples to produce shuffled even data samples;

   (c) shuffling each of the odd input data samples to produce shuffled odd data samples; and

   (d) combining in an alternating manner the shuffled even and odd data samples to produce the shuffled output data stream.

2. The method of claim 1, wherein said steps (b) and (c) are performed approximately simultaneously.

3. The method of claim 1, wherein each of steps (b) and (c) comprises shuffling in accordance with an $H(z^{-1})$ transfer function, such that the combining in step (d) effects a shuffling in accordance with an $H(z^{-2})$ transfer function, wherein $H(z^{-n})$ is defined as $H(z^{-n}) = (1-z^{-n})$.

4. The method of claim 1, wherein each of steps (b) and (c) comprises shuffling at one-half the sample rate *Fs*.

5. The method of claim 1, wherein:

said shuffling in said step (b) comprises swapping the even input data samples of the input data stream based on values of the even input data samples and an even state; and

said shuffling in said step (c) comprises swapping the odd input data samples of the input data stream based on values of the odd input data samples and an odd state.

6. The method of claim 5, wherein said shuffling in said step (b) further comprises swapping according to the following rules:

Current Even State	Even Input	Next Even State	Swap? Yes or No
S_0 (0)	$x_0 = x_1$	S_0 (0)	No
S_0 (0)	$x_0 \neq x_1$	S_1 (1)	Yes
S_1 (1)	$x_0 = x_1$	S_1 (1)	No
S_1 (1)	$x_0 \neq x_1$	S_0 (0)	No

wherein x_0 and x_1 are bits in a given even input data sample; and the next even state is a result of updating the current even state.

7. The method of claim 1, wherein:

said shuffling in said step (b) comprises choosing a unit digital-to-analog (DAC) element for the even input data samples of the input data stream based on values of the even input data samples and an even DAC pointer position; and

said shuffling in said step (c) comprises choosing a unit DAC element for the odd input data samples of the input data stream based on values of the odd input data samples and an odd DAC pointer position.

8. A method of removing residual tones in a shuffled output data stream having samples separated by one sample period, comprising:

(a) determining a new state of a swapper based on an incoming data sample and a current state of the swapper, wherein the

current state of the swapper has been delayed for at least one sample period;

(b) delaying the new state of the swapper for at least one sample period; and

(c) repeating steps (a) and (b) for each incoming data sample.

9. A system that performs dynamic element matching (DEM) on an input data stream having a sample rate equal to *Fs*, the input data stream including alternating even and odd input data samples, said system comprising:

(a) means for performing a DEM operation on each of the even input data samples to produce shuffled even data samples;

(b) means for performing a DEM operation on each of the odd input data samples to produce shuffled odd data samples; and

(c) means for combining in an alternating manner the shuffled even and odd data samples to produce an output data stream,

wherein said system substantially reduces *Fs/2* tones produced in the output data stream by each of said means for performing a DEM operation.

10. The system of claim 9, wherein each of said elements (a) and (b) comprises means for performing a DEM operation in accordance with an $H(z^{-1})$ transfer function, such that said element (c) effects a DEM operation in accordance with an $H(z^{-2})$ transfer function, wherein $H(z^{-n})$ is defined as $H(z^{-n}) = (1-z^{-n})$.

11. The system of claim 9, wherein each of said elements (a) and (b) comprises a means for performing DEM operations at one-half the sample rate *Fs*.

12. The system of claim 9, wherein

said element (a) comprises a means for performing a tree-structured DEM operation on each of the even input data samples; and

said element (b) comprises a means for performing a tree-structured DEM operation on each of the odd input data samples.

13. The system of claim 12, wherein each of said means for performing said DEM operation has a state value, and follows the following rules:

Current State	Input	Next Even State	Swap? Yes or No
S_0 (0)	$x_0 = x_1$	S_0 (0)	No
S_0 (0)	$x_0 \neq x_1$	S_1 (1)	Yes
S_1 (1)	$x_0 = x_1$	S_1 (1)	No
S_1 (1)	$x_0 \neq x_1$	S_0 (0)	No

wherein x_0 and x_1 are bits in a given input data sample; and a next state is a result of updating a current state.

14. The system of claim 13, wherein x_0 and x_1 represent multi-bit vectors.

15. The system of claim 9, wherein

said element (a) comprises means for performing a data weighted averaging (DWA) DEM operation on each of the even input data samples; and

said element (b) comprises means for performing a DWA DEM operation on each of the odd input data samples.